MODELING OF INDOOR CONCENTRATIONS AND TOXICOLOGICAL ASSESSMENT OF CANDLE BURNING EMISSIONS

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Background and Aims: the burning of candles is one of the most important indoor sources in terms of direct emission of airborne pollutants. The aim of this study is to determine and quantify the toxicological impact of some selected chemical products emitted from the burning process of candles.
Methods: the work investigated different types of candles selected on the basis of fragrances (bark, frangipane, opium, rhubarb, aloe) and raw materials (paraffin, slack wax, and 'intermediate' wax).
The analysed products of combustion were: BTEX, formaldehyde, acetaldehyde, acrolein, PAHs, CO, SO2, NO2 and particulate matter. The design and development of a combustion chamber enabled the standardization of the 'combustion system' with its several variables.
Exposure limits for each studied substance were selected analysing data in scientific literature and international guidelines.
Indoor concentrations were predicted by ConsExpo 4.0 model. The construction of exposure scenarios was focused on the worst-case conditions: 4 candles burned for 4 hours, minimum volume for an indoor environment (25 m3) and minimum ventilation (0.1 ach).
Results: estimated indoor airborne concentrations generated by the combustion of candles charged with fragrance oils exceeded only the acrolein exposure limit by an order of magnitude. However, the predicted indoor concentrations of acrolein were an order of magnitude lower than usual indoor background levels measured in urban areas.
As regards raw materials, slack wax showed concentrations an order of magnitude higher than particulate matter, SO2 and NO2 exposure limits. Moreover, benzo(a)pyrene concentrations were equal to the relative exposure limit.
Conclusion: the different chemical composition of candles and related raw materials significantly affects the emission factors and estimated indoor concentrations of the selected airborne pollutants.
The slack wax was characterized by some critical points in terms of possible health risks, owing to the differences in terms of oil percentage in raw materials.